



DIVERSITY AND COMPOSITION OF THE RIPARIAN SPIDERS OF CENTRAL MEKONG RIVER IN THAILAND

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บทคัดย่อ: แม่น้ำโขงเป็นแม่น้ำขนาดใหญ่ที่มีความหลากหลายทางชีวภาพสูงและเอื้อประโยชน์ในทางสังคม การสำรวจแมงมุมดำเนินการในระหว่างเดือนเมษายนถึงเดือนพฤษภาคม พ.ศ. 2555 พบตัวอย่างแมงมุมทั้งหมด 1,391 ตัว จำแนกเป็น 136 ชนิด 108 สกุล จาก 25 วงศ์ ในพื้นที่ป่าบุ่ง-ป่าทามพบแมงมุมมีความหลากหลายสูงที่สุด จำแนกแมงมุมตามโครงสร้างการหากินเป็น 6 แบบ ได้แก่ orb-web builders, foliage hunters, ground hunters, sheet web builders, scattered line weavers and ambushers และพบว่า orb-web builder มีความหลากหลาย สูงที่สุด วงศ์ Araneidae, Salticidae, Thomisidae, Tetragnathidae มีความหลากหลายชนิดสูง ในการศึกษาครั้งนี้พบแมงมุมสกุล *Pardosa* and *Hippasa* วงศ์ Lycosidae เป็นดัชนีชี้วัดว่าระบบนิเวศป่าริมน้ำมีสภาพไม่ดี ซึ่งการศึกษาครั้งนี้เป็นพื้นฐานสำหรับการศึกษาแมงมุมในระบบนิเวศริมฝั่งแม่น้ำในประเทศไทยต่อไป

Abstract: The Mekong is a large river with a high biodiversity and socio-economic benefits. Spider survey was investigated during April to May 2012 in the riparian forest. The high species diversity was detected. The result showed that a total of 1,391 specimens were collected from four habitats and four localities and identified to 136 species 108 genera of 25 families. Guild structure analysis of the collected spiders revealed 6 feeding guilds viz ., orb-web builders, foliage hunters, ground hunters, sheet web builders, scattered line weavers and ambushers, and the orb-web builder is the highest diversity. The families Araneidae, Salticidae, Thomisidae, Tetragnathidae, and exhibited high species diversity. *Pardosa* and *Hippasa* (Lycosidae) have a high potential as biological indicators for monitoring of riparian ecosystem and indicate the bad riparian conditions, which is serve as a baseline for future study of spiders in riparian ecosystems of Thailand.

Keywords: Mekong River, Riparian spiders, spiders, diversity, guild composition

INTRODUCTION

Spiders are one of the most ubiquitous and diverse groups of organisms have a worldwide distribution, occupying all land environments except at the polar extremes. Currently there are 43,244 species described from 111 families of spiders and are estimated to number 60,000–170,000 species (Coddington & Levi 1991; Platnick 2012). About 311 species were recorded in Thailand which search in the world spider catalog of Norman Platnick (2011) for country names. The Mekong is the tenth-largest river in the world, the basin of the river drains a total land area of 795,000 km² from the eastern watershed of the Tibetan Plateau to the Mekong Delta. This river flows approximately 4,909 km through three provinces of China, continuing into Myanmar, Lao PDR, Thailand, Cambodia and Viet Nam before emptying into the South China Sea (MRC, 2012), and is one of the world's tropical river floodplain ecosystems, with a high biodiversity and socio-economic benefits of Southeast Asian countries. The riparian areas of Mekong river is integral part of the everyday life for almost the entire population of the basin which are contained with agro-ecosystem and natural forest. Due to the scarcity of workers much of the spider diversity in the Mekong riparian remains unexplored. Considering the importance of spiders in the natural suppression of many insect pests and as bioindicators, urgent efforts are needed to understand their diversity. The aims of this study were to investigate the diversity of spiders in this riparian ecosystem of central Mekong River in Thailand. Though the study of spiders from

Mekong region is still far from complete, the present study forms a basis for further investigations on this group.

MATERIALS AND METHODS

The Mekong River is divided 3 regions in this study; the upper from the Tibetan Plateau, the Yunnan province of China to Nam Mae Kok and Nam Mae Ing in Chiang Rai Province Thailand, the central from Chiang Saen to Kong Chiem, Ubon Ratchatani, Thailand, and the lower from Kong Chiem, Thailand to the Mekong Delta in Vietnam. The study sites are located along the central of the region, an approximately 600 km along the broader of Lao and Thailand. It is situated at 20°21.183' N latitude and 100°1.183' E longitude to 15°19.05' N latitude and 105°30.317' E longitude, and a part of Eastern Thailand. About 90% of the total study area lies between 69 - 368 m. above mean sea level. Annual rainfall is 1,000 -1,600 mm, there is more rain in June - August. The climate is classified as tropical monsoonal, in the warmest months of March and April, average temperature ranges from 30°C to 38°C and cooler temperatures prevail from November to February. The riparian vegetation comprises mostly of seasonal flood forests (freshwater swamp forest), seasonal cultivate areas, and riparian grassland. The effect on dry season to the Mekong River was chosen for study because it contains the highest number of substrate types and habitats. The following localities along the river were classified to 4 habitat types and described; open sand area, riparian grassland, shrub, and seasonal flood forest. Four collecting period and four localities were

investigated; on 6-8 April 2012 at Khong Chiem, Ubon Ratchatani Province, 11-15 April 2012 at Chiang Saen, Chiang Rai Province, on 24-27 May 2012 at Bung Khan Province, and on 28-30 May 2012 at Pak Chom, Loei Province. The sampling procedure included four methods chosen to access all microhabitats in these four habitat types: direct searching, sweep-netting, litter sampling, and beating. The direct searching methods are synonymous with the “looking up” and “looking down” methods of Coddington et al. (1991), and were made at night on 07.00-09.00 pm, and in day light on 06.00-09.00 am. The sweep-netting and beating methods were adopted from Toti et al. (2000) and Cardoso et al. (2009). Litter sampling methods were made by sifter with a 1 cm mesh diameters. Ninety-six samples were collected, 64 of which inside 4 m wide and 50 m long transects. All specimens that were collected were stored in glass vials in 80% alcohol and labelled. Spiders were identified to family and species using existing identification keys wherever possible (Tikader 1980, 1982; Barrion and Litsinger 1995; Koh 1996; Daxiang, Mingsheng and Jun 1999; Murphy and Murphy 2000; Deeleman 2001; Jocque and Dippenaar-Schoeman 2006). Due to lack of available identification keys for many families and the time required for conventional taxonomic work, a morphospecies approach was used to classify spiders. Global Positioning System hand unit (GPS) was used to determine the exact geographical locations. The identification of spiders was done following Species richness was estimated for each vegetation type, as well as for the regional data set using the nonparametric estimators

Chao1 and Jackknife 1. Species richness and accumulation curves were generated after 100 randomizations using EstimateS 8.2 (Colwell 2009). Chao1 gives an estimate of the absolute number of species in an assemblage based on the number of rare species (singletons and doubletons) in a sample.

RESULTS AND DISCUSSION

1. Spider diversity

A total of 1391 specimens representing 25 families, 108 genera, and 136 species, which represent 43.72 % of spider species recorded in Thailand. The pooled species accumulation curve reached an asymptote for both Chao1, Jackknife 1, and Bootstrap (Fig. 1), indicating that sampling was almost complete at the regional level. The estimated total species richness using Chao1 was 151 ± 8.04 (SD), Jackknife 2 was 173.6 ± 9.27 (SD) and using Bootstrap was 155 ± 0.96 for the complete sample. From all species recorded, 26 were singletons (19.12% of all species) and 20 were doubletons (14.70% of all species). The Araneidae was the dominant family in this study, which is composed of 27 species of 16 genera (357 individuals, 20%). Salticidae was the next dominant family with 19 species of 16 genera (14%). Tetragnathidae (14 species; 10%), Thomisidae (13 species; 9%) and Theridiidae (11 species; 8%) was the order of dominance of the other major families in this ecosystem (Table 1.) The ecological groups of spiders were divided four riparian habitats (Figure 2.); 101 species (42%) were found in Seasonal flood forest, followed by shrub habitats

with 79 species (32%). In terms of individual specimens the most abundance were collected from grass field (38%) and shrub (28%). The most abundant species was *Pardosa pseudoannulata* (Lycosidae) (81 individuals) and most of the individuals were found at open sand habitats. *Pardosa* and *Hippasa* have a high potential as biological indicators for monitoring and assessing the effect of anthropogenic disturbance in riparian ecosystem. This results showed that number of individuals of Lycosids tended to increase with high increasing of open sand and grassland habitats.

2. Guild composition

The collected spiders can be divided into six functional groups based on their foraging behavior in the field (Uetz *et al.* 1999). The dominant guild was of the orb web builders (Table. 1) and it comprised of 48 species from 5 families, the families Araneidae, Tetragnathidae Nephilidae, Uloboridae, and Psechridae fall under this category. Spiders of the category foliage hunters formed the next dominant guild in this ecosystem comprising of 27 species and it comprised 6 families. Ambushers (19 species), ground hunters (18 species), scattered line weavers (18 species) and sheet web builders (8 species) are the other functional groups. The orb-web builders dominated the material, being represented by *Leucauge decorata* (Tetragnathidae), followed by *Zygiella calyptrate* (Tetragnathidae), *Araneus mitificus* (Araneidae), and *Tetragnatha javana* (Tetragnathidae). The Thomisidae is the most abundance of ambushers were presented by

Runcinia albostrata and *Amyciaea lineatipes*. *Pardosa pseudoannulata* and *Hippasa* sp. are dominantly ground hunters, and belong to family Lycosidae. The most abundance of foliage hunters is *Oxyopes javanus* (Oxyopidae).

The present study is the first of its kind in the Mekong river and is one of the few studies on spider communities in Thailand, and there is no previous work to compare the spider diversity. Spiders were divided according to their functional group there was a significant effect of habitat on the diversity. The web building and foliage running spiders rely on vegetation for some part of their lives, either for finding food, building retreats or for web building. The structure of the vegetation is therefore expected to influence the diversity of spiders found in the habitat. Comparatively, seasonal flood forests exhibit highly diverse assemblages, possibly due to higher structural complexity. The relatively open and diverse overstorey and understorey structure of seasonal flood forest supported the highest number of spider species while closed shrub habitat supported relatively few (Hore and Uniyal, 2008). Diversity generally increases when a greater variety of habitat types are present (Ried and Miller 1989). Uetz (1991) suggests that structurally more complex shrubs can support a more diverse spider community. Downie *et al.* (1999) and New (1999) have demonstrated that spiders are extremely sensitive to small changes in the habitat structure, including habitat complexity, litter depth and microclimate characteristics. There are many environmental factors, including the human activities that effect to species diversity. Currently

there are many hydroelectric developments, other human activities effect to the riparian spider fauna. Specifically, water drainage from the large dam effect to riparian ecosystem. Furthermore, the freshwater swamp forests is often chopped down

or converted to agricultural land along the Mekong and the river banks. Therefore, documenting spider diversity in this ecosystem can provide important information to justify the conservation of this ecosystem.

Table 1 Number of species of spiders, rare species (singletons and doubletons), and feeding guild of riparian spiders of central Mekong river in Thailand.

Family	Guild	Number of	Number of	Number of	Number of
Araneidae	ORB	357	27	3	2
Tetragnathidae	ORB	252	13	1	2
Lycosidae	GH	218	4	0	0
Thomisidae	AMB	106	13	0	4
Oxyopidae	AMB	66	4	0	0
Salticidae	FH	73	19	5	6
Sparassidae	FH	49	3	1	0
Linyphiidae	SWB	46	7	3	1
Theridiidae	SIW	41	11	2	3
Pholcidae	SIW	29	2	0	0
Pisauridae	SIW	29	4	1	0
Nephilidae	ORB	24	5	1	0
Uloboridae	ORB	20	2	0	0
Clubionidae	AMB	14	2	1	0
Zodariidae	GH	13	3	0	0
Miturgidae	AMB	10	2	1	0
Hersiliidae	FH	9	1	0	0
Ochyroceratidae	SIW	8	1	0	0
Scytodidae	GH	7	1	0	0
Corinnidae	GH	5	4	3	1
Philodromidae	AMB	5	2	0	1
Oonopidae	GH	3	1	0	0
Psechridae	ORB	3	1	0	0
Gnaphosidae	GH	3	3	3	0
Theraphosidae	GH	1	1	1	0
		1391	136	26	20

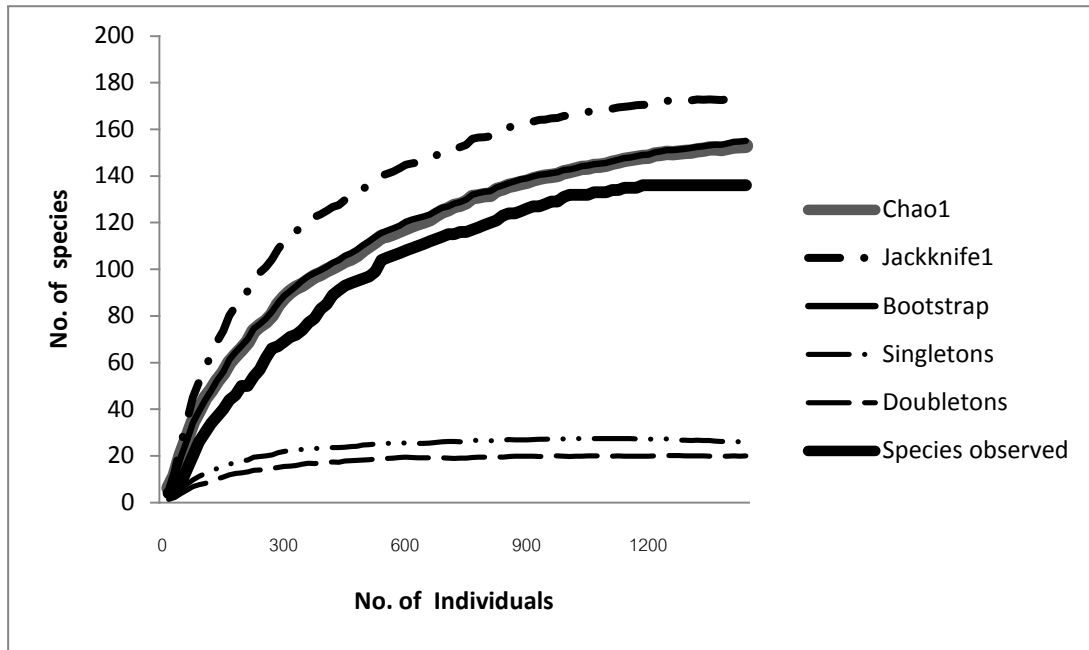


Figure 1 Species-accumulation curve and estimation curves Chao 1, jackknife 1, and bootstrap for the 96 samples combined. The accumulation curves for singletons and doubletons are also presented

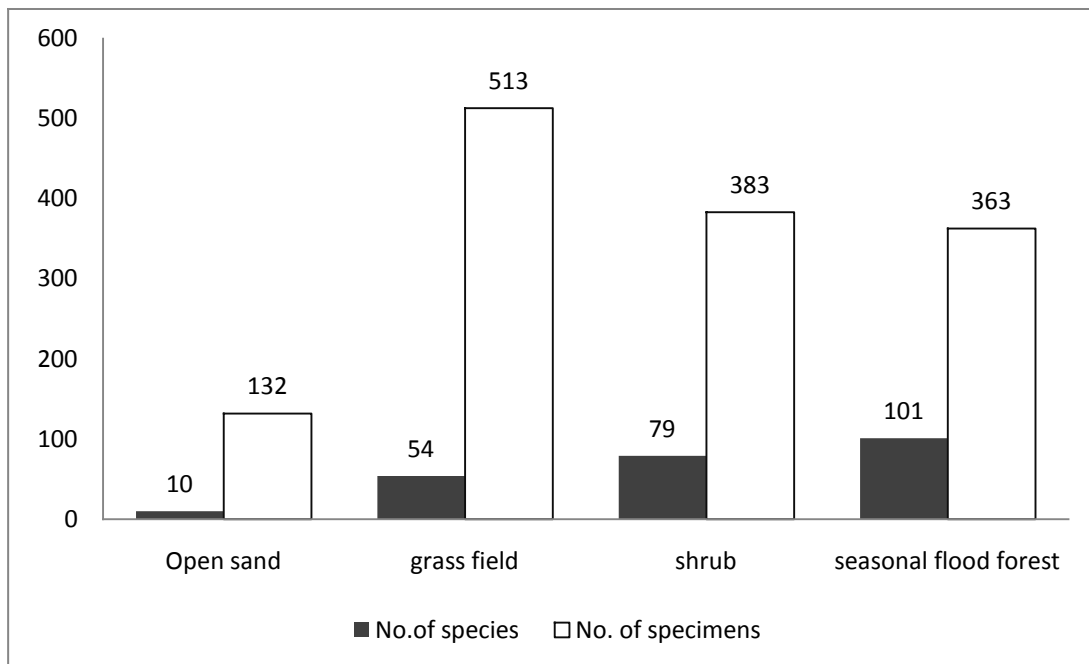


Figure 2 Number of species and number specimens of spider assemblages across the different habitat types. Open sand, grass field, shrub, and season flood forest

CONCLUSIONS

The results presented here 25 families, 108 genera, and 136 species, which represent 43.72 % of spider species recorded in Thailand. The Araneidae was the dominant family, which is composed of 27 species of 16 genera, and the dominant guild was of the orb web builders and it comprised of 48 species from 5 families, the families Araneidae, Tetragnathidae Nephilidae, Uloboridae, and Psechridae fall under this category. The highest diversity were found in Seasonal flood forest. Spider diversity and feeding guild depend on the vegetation structure and habitat types of riparian ecosystem. *Pardosa* and *Hippasa* (Lycosidae) have a high potential as biological indicators for monitoring and assessing the effect of riparian ecosystem and indicate the bad riparian conditions.

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